

MOMORDICA GROSVENORI SP. NOV.
THE SOURCE OF THE CHINESE LO HAN KUO

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With two plates

IN 1932, while engaged in an agricultural survey of Kwangsi Province for the able and energetic military governor, Marshal Li Ts'ung-jen, Prof. George Weidman Groff of Lingnan University, Canton, China, discovered that the "lo han kuo," a plant widely used in household medicine in southern China, which he had been vainly seeking for many years, is cultivated in the mountains near the capital city of Kweilin by the non-Chinese Miao-tze people. Later, Prof. and Mrs. Groff visited the Kweilin region as guests of Marshal Li, who was born in this region and still maintains a residence there. On this trip visits were made to the Miao-tze villages but no living plants of the mysterious "lo han kuo" were seen. Marshal Li, however, sent a number of the swollen rootstocks to Prof. Groff at Canton, where they produced leafy shoots but no flowers, probably because of the high summer temperatures. These plants were the first of this species ever seen by botanists!

In order to learn exactly where and how the plant is cultivated, Prof. Groff requested a grant from the National Geographic Society through the late Dr. Frederick V. Coville, Chairman of the Research Committee, who with myself had been for many years anxious to find the source of "lo han" fruits and to identify the plant that produces them. Dr. Gilbert Grosvenor, President of the Society, approved the grant, and with the cooperation of Lingnan University of Canton, China, a special expedition, headed by Prof. Groff, was sent to Kweilin and vicinity in August, 1937.

The "lo han kuo" is a cucurbitaceous vine cultivated in northern Kwangsi by the Miao-tze people, who train it over horizontal trellises in special gardens cleared in the mountain forests. Abundant herbarium specimens and photographs of it were brought back by this expedition and turned over to me for identification. It became evident upon careful study of this material that it constitutes a new species of *Momordica* very distinct from any now known to botanists. I take pleasure in naming it *Momordica Grosvenori*, in honor of Dr. Gilbert Grosvenor, who for many years has encouraged liberally the geographic and botanical exploration of China.

Momordica Grosvenori sp. nov.

Ab aliis speciebus *Momordicæ* differt seminibus applanatis radialiter striatis sulcatisque, margine rima lata profunde percursis, embryo ovato-lenticulari quam semine multo minore, fructus pulpa dulcissima in sicco in massam fibrosam levem coalescente, tota superficie plantæ (facie superiore folii excepta) pilis minutissimis nigris ornata, folii margine sparse irregulariterque hydathodibus instructo.

A dioecious vine, climbing to 2-5 m., the roots perennial, tuberous, fusiform when young, finally subglobose, 10-15 cm. in diameter. Stems slender, the internodes 3-9 cm. long, the axillary tendrils 8-12 cm. long, bifid above the middle. Petioles slender, 2-7 (usually 3-5) cm. long, 1-2 mm. in diameter, longitudinally striate. Leaf-blades thin, ovate-cordate, sometimes hastate and nearly triangular in outline, 8-15 (rarely to 23) cm. long, 3.5-12 (rarely to 17) cm. broad, acute or acuminate at apex, deeply cordate-emarginate at base with a cuneate juncture with the petiole (see *pl. 2, fig. 1*), the margins entire, irregularly and coarsely crenulate, or shallowly lobed, very rarely with callose spatulate hydathodes projecting beyond the margins in continuation of veinlets, the lateral veins 4 or 5 pairs on each side of the midrib, the lower pair running close to the margin of the cordate sinus but soon branching into 3 or 4 strong veinlets, the 3 or 4 pairs in the upper part of the leaf-blades not showing such strong veinlets, the upper surface and margins with scattered short white or light buff hairs, the lower surface with similar hairs and also with characteristic widely scattered minute black hairlets (also found on all exposed surfaces of stems, tendrils, petioles, peduncles, pedicels, ovaries, and the outer surfaces of sepals and petals). Pistillate inflorescences clustered (2 or 3) in leaf-axils or sometimes solitary, either with simple pedicels bearing a single flower or with peduncles 3-5 cm. long bearing 2-5 flowers on pedicels 0.5-1.5 cm. long, the pedicels subtended by finely pubescent bracts 2-3 mm. long and 0.5-1 mm. broad, the bracts often caducous or lacking. Ovary inferior, oblong-ovoid, 8-10 mm. long, 3.5-4.5 mm. broad, rounded at base, 3-locular, with numerous ovules in 6 rows (see *pl. 1, fig. 2, 3, pl. 2, fig. 2*). Sepals 5, persistent, soon reflexed, 5-7 mm. long, 1.5-2 mm. broad at base, tapering into thread-like pubescent tips. Petals 5, free, thin, yellowish, lanceolate-acuminate, 20-23 mm. long and 6-7 mm. broad (in dried state), with 6 or 8 subparallel veins. Staminodes 3, slender, 2-2.5 mm. long, two of them paired, one single. Styles 3, 4-5 mm. long, 3-lobed, sometimes each lobe bifid (see *pl. 2, fig. 2*). Staminate inflorescence racemose, arising singly in leaf-axils, 9-13 cm. long, unbranched for 6-8 cm. at base, the upper portion bearing 4-15 more or less appressed pedicels 1-3 cm. long and 0.5-1 mm. in diameter, the

pedicels sometimes subtended by minute slender bracts 2–3 mm. long and 0.5–0.8 mm. broad. Staminate flowers single. Calyx funnel-shaped, 5-lobed above, the lobes 6–9 mm. long, 2.5–3.5 mm. broad at base, attenuate into slender thread-like finely pubescent tips. Petals 5, free, thin, yellowish, lanceolate-acuminate, 18–25 mm. long and 6–8 mm. broad (in dried state, possibly larger in fully developed fresh flowers). with 6 or 8 veins, two of the petals (nos. 1 and 2) bearing near the base bluntly rounded flaps (2–3 mm. long, 1.5–1.8 mm. broad, minutely pubescent above and ciliate at margins with nearly hyaline hairs, overlying those arising from the bases of the stamens). Stamens 3, two of them with a pair of anthers, the other with a single anther; filaments 3–4 mm. long (usually doubled above in the stamens with 2 anthers); anthers subtriangular, 4–5 mm. long, 2–2.5 mm. broad, extrorse, dull reddish brown on inner side, each anther with a single S-shaped pollen-locule with the outer descending arm longer (3 mm.) and the inner ascending arm shorter (2–2.5 mm.); filaments at base more or less irregularly expanded into sheets of tissue which extend under the petal-flaps and together with them almost completely cover the nectary. Fruits broadly ellipsoid, ovoid or subglobose, with broadly rounded ends. 6–11 cm. long, 3–4 cm. broad, more or less densely pubescent with yellowish (rarely reddish) hairs intermixed with numerous black hairlets, often with 6 (or more?) longitudinal stripes (see *pl. 2, fig. 6*), the peel very thin (0.5–0.8 mm. thick), the three doubled locules each with 2 rows of seeds (about 10–12 in a row) with slightly brownish gray pulp which dries to a light fibrous mass, intensely sweet in taste and with an aromatic odor and flavor (somewhat like licorice). Seeds light brownish gray, broadly oval or ovate, flattened, 15–18 mm. long, 10–12 mm. broad, 3–4 mm. thick at edges but with a depressed area (8–9 mm. long, 3–4 mm. broad) in the center of each side, surrounded by a ring of raised tissues which is radially striate and sparingly furrowed (see *pl. 2, fig. 4*), the margin deeply sunk as if eroded (see *pl. 2, fig. 4, 5*), the embryo ovate-lenticular, much smaller than the seed, 7.5–9 mm. long, 3.5–4 mm. broad, 1.8–2 mm. thick, the testa very thin; smooth (see *pl. 2, fig. 3*).

TYPE: CHINA: Kwangsi Province: Pai-shou (Po-seh) District, Niu-ho village, near Chien-kan, *Taam Ying-wah 1* (♀), 15 ft. tall, Aug. 17, 1937, cultivated in garden, 15 Chinese feet high, in Herb. National Arboretum; Dupl. Herb. Arnold Arboretum. Serial microtome sections S. and T. 508 A, slides 1–8 (longitudinal sections of half an ovary); 508 B, slides 1–12 (cross-sections of the other half of 508 A); 508 C, slides 1–20 (cross-sections of an entire ovary); 716 A, slides 1, 2, 716 B, slide 1 (cross-sections of leaves); all filed in type collection of Herb. National Arboretum.

ADDITIONAL MATERIAL: Kwangsi Province: Pai-shou District, Pao-an community near Pan-pu village, *Taam Ying-wah* 69 (♂), PARATYPE, (in Herb. Nat. Arb. and Herb. Arnold Arb.). Serial microtome sections S. and T. 509 A, slides 1-7 (cross-sections of flower-bud); 509 B, slides 1-7 (longitudinal sections of flower-bud); 717 B, slide 1 (48 cross-sections of a flower-bud); 717 C, slides 1-7 (cross-sections of flower-bud); 717 D, slides 1-8 (longitudinal sections of flower-bud); 717 E, slides 1-33 (longitudinal sections of nearly mature flower); 717 A, slide 1 (cross-sections of leaf); all filed in type collection of Herb. Nat. Arb. Pai-shou District, Chih-lung village, *Taam Ying-wah* 22 (♀) (in Herb. Nat. Arb. and Herb. Arnold Arb.). Boundary between Pai-shou and Kwei-lin Districts, Liu-ch'a mountains, alt. 2000 ft. (609 m.), *Groff, Hoh, & Tung* 21172 (♀), Aug. 9, 1937, "Ch'ang han kuo" variety (in Herb. Nat. Arb. and Herb. Arnold Arb.). Boundary between Kweilin and Pai-shou Districts, Liu-ch'a mountains, *Groff, Hoh, & Tung* 21173 (♀), Aug. 9, 1937 (in Herb. Nat. Arb.). Pai-shou District, San-wa village, near San t'ai mountain, *Taam Ying-wah* 5 (♀), Aug. 18, 1937 (in Herb. Nat. Arb. and Herb. Arnold Arb.). Serial microtome sections S. and T. 729 A, slides 1-12 (cross-sections of young ovary); 729 B, slides 1-3 (cross-sections of young fruit); all filed in Herb. Nat. Arb. Clay slope near Pan-pu village of Po-an, *Taam Ying-wah* 67 (♀), Aug. 27, 1937 (in Herb. Nat. Arb.), *Taam Ying-wah* 71 (♀), "Ch'ang t'an tzu" variety (in Herb. Nat. Arb.). Shih-lung village, *Taam Ying-wah* 41 (♀), Aug. 22, 1937, "Ma ling tsu" variety (in Herb. Nat. Arb. and Herb. Arnold Arb.). Hsing-an District, Sai-on village, *T. S. Tsoong* 83644 (♀), Aug. 27, 1937, young fruits red (in Herb. Arnold Arb.). Hsiang District, Yao Mountain, Ku-ch'ên, alt. about 5000 ft. (1570 m.), *Huang Chi* 40248, seen by Prof. Groff and Hoh Hin-cheung, marked "lo-han-kuo," with green fruits only (in Herb. Sun Yatsen Univ. no. 97307).

Kiangsi Province: Chung-jên District, near Li-pei-chiao, alt. 200-700 m., *Y. Tsiang* 10200 (♀), July 7, 1932 (in Herb. N. Y. Bot. Gard.).

Kwangtung Province: Hainan Island, Chang-kiang District, O-kao (Ngo-ko) Mt., near Chin-ch'i (Tsat cha) village, *S. K. Lau* 1925 (♂), June 12, 1933 (in Herb. Arnold Arb., Gray Herb., and Herb. Nat. Arb.). Hainan Island, Kan-ên (Kum-yun) District, *S. K. Lau* 27685 (♂), Aug. 18, 1936; "fruit scarlet" (on ♀ plants) (in Herb. Arnold Arb.). Serial microtome sections S. and T. 721 A, slide 1 (cross-sections of leaf); 721 B, slides 1-7 (cross-sections of flower-buds); 721 C, slides 1-4 (longitudinal sections of flower-buds); all filed in Herb. Nat. Arb.

The two collections of wild plants growing in Hainan Island were studied by Dr. E. D. Merrill, Director of the Arnold Arboretum, and by Dr. Franklin P. Metcalf, Botanist of Lingnan University at Canton, China, and were found by them to represent a new species of cucurbitaceous plant native in China. When it became obvious that these Hainan plants belonged to the same species as the one cultivated in Kwangsi province, the dried material, notes, and drawings of the Hainan material were turned over to me so the species could be based on the more abundant collections of both male and female plants. I wish to take this occasion to render thanks for this most generous action.

As appears from the above enumeration of the known material, *Momordica Grosvenori* is known from three rather widely separated regions in southwestern China: (1) the mountains westward from Kweilin in the northeastern part of the province of Kwangsi, where it is intensively cultivated in several districts at altitudes of 600 meters and over (found growing wild at 1570 meters); (2) about 600–700 kilometers northeast of Kweilin in the north-central portion of Kiangsi Province in Chung-jên district southwest of Yang-po lake, at altitudes of 300–700 meters; (3) about 700 kilometers south of Kweilin in two districts of Hainan Island at altitudes of 610 meters or over. In Kwangsi province it grows in the mountains in shady forests where *Cunninghamia lanceolata*, the tea-oil tree, *Thea sasanqua*, and the wood-oil tree *Aleurites Fordii* are native. In these foothill mountain forests, rains and fogs are frequent in the summer season. "Lo han kuo" tubers transplanted by Groff from Kweilin to Canton near sea level gave rise to vigorous vines but did not flower.

Four principal varieties of the "lo han kuo" are grown in the Miao-tze country, where they are propagated by dividing the tuberous roots. These varieties show rather striking differences in the shape and color of the fruit and in the shape and size of the leaves, and also in the degree of evenness of the leaf-margins. In some varieties a very few hydathodes can sometimes be detected along the leaf margins, but more often they are wanting entirely. Nothing is known as to the fruit characters of the wild plants of *Momordica Grosvenori*. The leaves of the Kiangsi province plant (*V. Tsiang 10200*) are the largest known, reaching 23 cm. in length and 13 cm. in width. Those of the Hainan Island plant (*S. K. Lau 1925*) are the smallest, 6.5–8 by 3.5–5 cm. Male plants are not cultivated by the Miao-tze people and for this reason are seldom seen. Flowers collected from the wild plants growing in the mountains are used by the Miao-tze people to pollinate the cultivated female plants.

Momordica Grosvenori, in common with a number of other species of *Momordica*, has the double nectary protection by two basal petal flaps

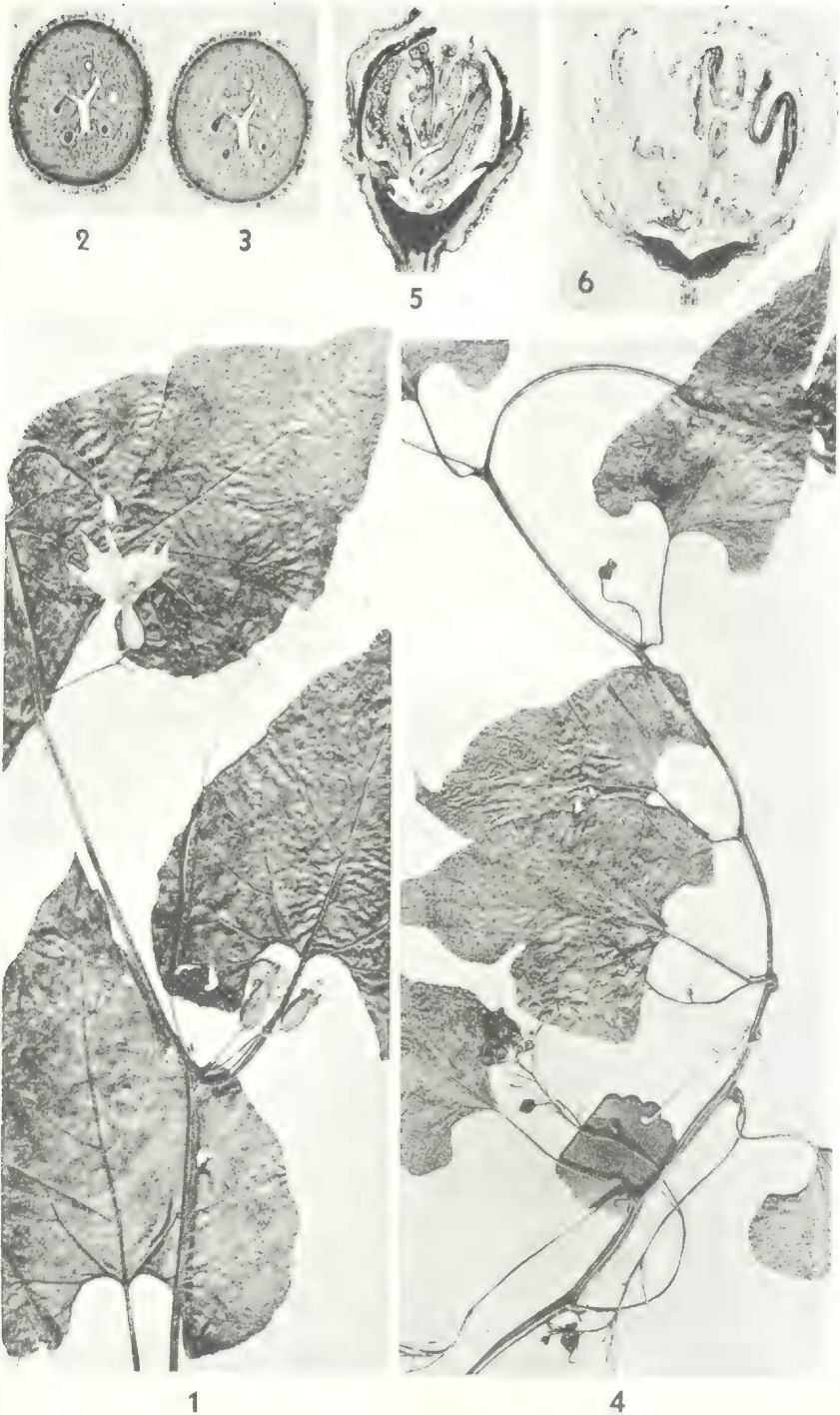
supplemented by broad proliferations from the bases of the 3 stamens, very similar to that described and figured in *M. trifoliata* by A. Zimmermann (Die Cucurbitaceen 2: 61-62. fig. 44, 45. 1922). Several other species of *Momordica* studied in minute detail in East Africa by Zimmermann show striking homologies with *M. Grosvenori* in the morphology of the male flowers.

A species of *Momordica* native to northern French Indochina, *M. tonkinensis* Gagnep. (in Bull. Mus. Hist. Nat. Paris 24: 376. 1918; figured in Flore gén. de l'Indo-Chine 2: 1070. fig. 120 [5-8]. 1921), presents certain analogies to the "lo han kuo," and may prove to be a somewhat related species. The general appearance of this plant is evidently much like that of *M. Grosvenori* and its leaves are said to be "atro-glandulosa" on the under side, but it is not stated whether this is due to the presence of scattered black hairs as in the "lo han kuo." The fruits are unknown and the male inflorescences differ from those of the "lo han kuo" in having a very short corymb containing 12-15 flowers borne at the end of a peduncle 9-11 cm. long. It is described as having five free stamens. The male flowers have broad and rather bluntly pointed sepals very different from those of *M. Grosvenori*, which has the sepals long-acuminate, ending in slender thread-like tips.

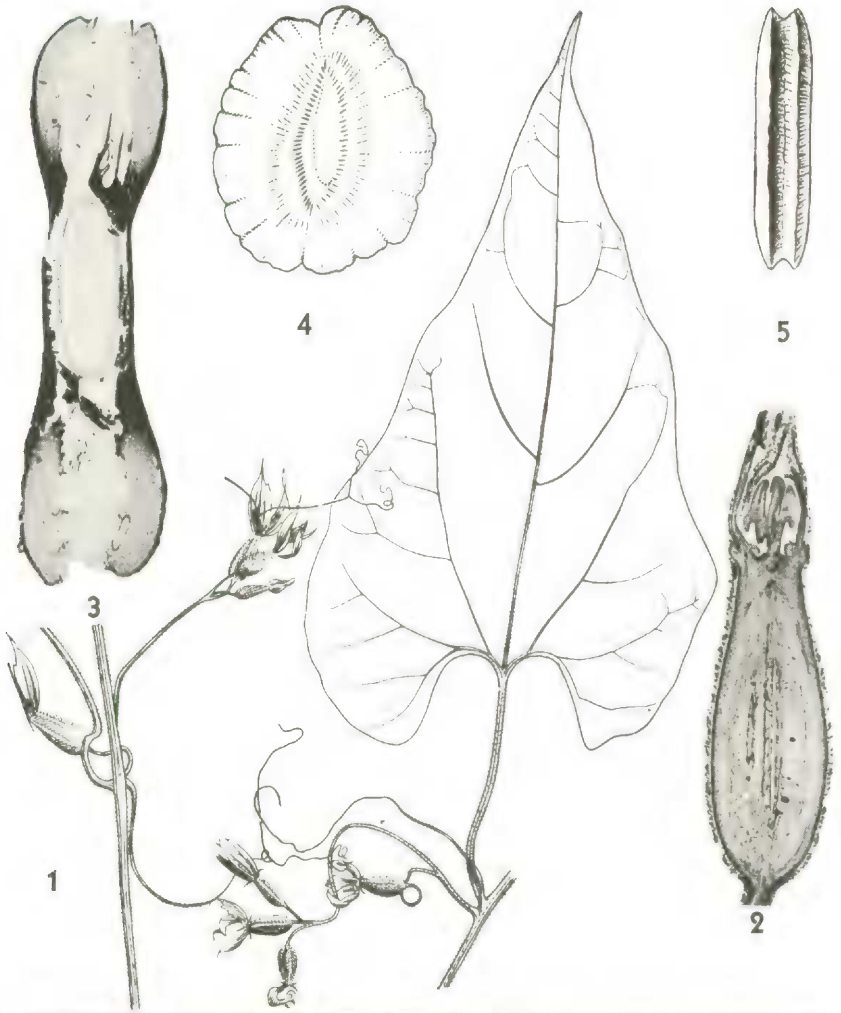
The "lo han kuo" is a small gourd-like fruit having an intensely sweet taste, widely used by the South Chinese as a household remedy for colds, sore-throat, and minor stomach and intestinal troubles. From the studies of Prof. Groff and his Chinese assistants, it appears that about 1000 tons of the green fruits are delivered every year to the drying sheds at Kweilin. The fruits lose much weight in drying and are then packed in boxes and shipped to Canton where most of the crop is consumed, but large numbers of the "lo han" fruits are exported to the Cantonese living in the United States and other over-sea countries.

Professor Groff was able to secure seeds of the "lo han kuo" near Kweilin in 1937 and found they retained their viability for a long time. Some of the seeds were planted at Lingnan University, Canton, China. The young seedlings soon developed fusiform roots. Half a dozen of these roots were recently presented to the Division of Plant Exploration and Introduction of the Bureau of Plant Industry by Professor Groff¹ through the National Geographic Society. It is hoped that these plants

¹I wish to render here grateful acknowledgment to Professor G. Weidman Groff, not only for these living plants, but also for all of the details mentioned in this paper regarding the culture and curing of the "lo han kuo," which were taken from a manuscript report by Groff and Hoh on their trip to northern Kiangsi made in 1937. This report was put in my hands by Dr. Gilbert Grosvenor, President of the National Geographic Society, in order to aid me in determining the taxonomic status of this plant.



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represent both sexes and that cuttings from them may be tested at different altitudes and different climates in hope of finding localities in the United States where this remarkable plant can be grown successfully. This will permit much better material than that now available to be obtained for use in determining its relationships in the genus *Momordica*.

EXPLANATION OF PLATES

PLATE 1

Momordica Grosvenori Swingle. Female plants: Fig. 1, *Taam 22*; Fig. 2, 3, type, *Taam 1*. Male plant: Fig. 4, 5, 6, paratype, *Taam 69*.

FIG. 1. Flowering twig. $\times \frac{1}{2}$.

FIG. 2, 3. Serial microtome cross-sections of ovary, showing 3 locules, each with 2 rows of ovules, also both pale yellow and black hairs covering the outer wall. $\times 6$.

FIG. 4. Flowering twig, showing slender racemose δ inflorescences. $\times \frac{1}{2}$.

FIG. 5. Longitudinal microtome section of δ flower-bud, showing petal flap (right) and growth starting to form at base of filament (left). $\times 6$.

FIG. 6. Longitudinal microtome section of nearly mature δ flower showing (to right) petal flap which overlaps the proliferation at base of the staminal filament growing over the nectary, also 2 S-shaped pollen-locules of 2 anthers. $\times 3$.

PLATE 2

Momordica Grosvenori Swingle. Female plants: Fig. 1, 2, *Taam 22*; Fig. 3, seed from a fruit purchased in a Chinese shop in San Francisco; Fig. 4, 5, *Taam 71*, *Ch'ang t'an tzu* variety, from Jose Gomez' drawing No. 17; Fig. 6, three cured fruits of the *Ch'ang t'an tzu* variety, Groff photograph No. 1206.

FIG. 1. Flowering branch, showing δ inflorescences with flower-buds and flowers, from Jose Gomez' drawing No. 9. $\times \frac{1}{2}$.

FIG. 2. Longitudinal microtome section of young ovary showing numerous ovules, 3-parted style, and abundant small pale yellow and black hairs covering outer wall, microtome section. $\times 10$.

FIG. 3. Cross-section of mature seed showing the outline of the small embryo and the collapsed tissues of the erose margin. $\times 6$.

FIG. 4. Mature seed showing radial striae and furrows, also depressed area over the embryo in the center. $\times 2$.

FIG. 5. Side view of seed showing erose margin. $\times 2$.

FIG. 6. Cured and polished fruits of *Ch'ang t'an tzu* variety. $\times \frac{1}{2}$.

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